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ABSTRACT

This curriculum guide states the cognitive goals of the mathematics program in the Province of British Columbia school system. Five major goals are stated as are specific learning outcomes for each grade level. The goals are organized around nine strands: (1) sets and set operation; (2) number and number operations; (3) geometry; (4) measurement; (5) problem solving; (6) graphs and functions; (7) applications of mathematics; (8) logical thinking; and (9) probability and statistics. The appendix contains a textbook list, materials and equipment, and supplementary and reference materials. (MP)

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PROVINCE OF BRITISH COLUMBIA

MINISTRY OF EDUCATION

DIVISION OF EDUCATIONAL PROGRAMS — SCHOOLS

CURRICULUM DEVELOPMENT BRANCH

MATHEMATICS

Curriculum Guide
Years One To Twelve

VICTORIA, B.C.

1977

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I. GENERAL STATEMENT

Mathematics in the traditional curriculum consisted largely of computational arithmetic. This aspect of mathematics has played, and will continue to play an important part in the education of our children. Mathematics programs now being prepared focus upon developing in students a freedom to explore, to look at new probelms in the light of past experience and knowledge, and to reach out for novel approaches or solutions.

Before any formal mathematics can be understood there must be a wealth of manipulative experiences through which concepts and relations are understood at an intuitive level. Mathematics as a discipline, as a formal structure, must be built upon a sound foundation of concrete experiences. Formal study of mathematics as a structured discipline is the function of post-elementary education.

The intuitive understanding of mathematical concepts and relations is not sufficient. A child must be able to perform or "do mathematics." At the elementary level it is important the mathematics program include facts, computation and processes.

A mathematics program must teach children to solve problems. Problems start in the physical world and are translated into the language of mathematics for ease of handling. The solutions are given meaning by relating them back to the physical world. Wherever possible, as new topics, concepts or processes are introduced the student should be presented with realistic problems related to the concrete world.

Fundamental to the program in dealing with these problems is the following sequence of activities:

a) manipulative, exploratory activities with real objects;

b) simulative activities with non-representational 3-D materials;

c) simulative activities with pictorial representational materials;

d) simulative activities with pictorial non-representational materials;

e) graphical representation or model building activities;

f) construction of a mathematical model;

g) application of appropriate algorithms or mathematical processes;

h) development of a generalized mathematical model for future use.

As students progress through the program and as topics, concepts and processes reach the upper levels of development, the time devoted to concrete and semi-concrete activities decreases in relation to the time spent in more abstract activities.

It may not be necessary or possible in every case to begin at the concrete level. If the material is of such a nature that first hand experience is impractical or if previous experiences have developed the underlying concepts, then initial activities may be at the semi-concrete or abstract level.

On occasion insight into the structure of the mathematics of the situation may allow certain students to go quickly through or skip altogether some steps in the process.

SEQUENCE OF ACTIVITIES

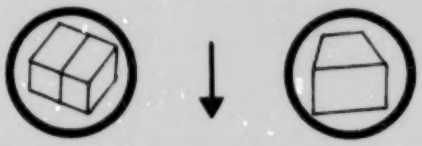
The following is a simple illustration of a sequence of activities.

CONCRETE

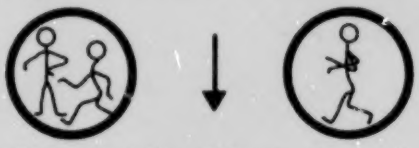
Two people are in a room.
One person comes into the room.
How many people are now in the room?

↓

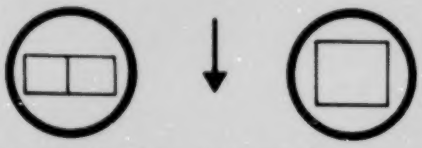
Act out using real people.



Demonstrate using blocks

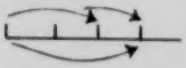


Illustrate using pictures of people.



Illustrate using pictures of blocks.

↓



Construct a graphical model.

$$2 + 1 = n$$

Write the number sentence.

$$\begin{array}{r} 2 \\ +1 \\ \hline 3 \end{array}$$

Solve by addition.

$$a + b =$$

$$a + b = n$$

Write a generalized statement.

ABSTRACT

A problem is perceived.

↓

Real objects are manipulated to arrive at solutions.

↓

Nonrepresentational concrete objects are manipulated to arrive at solutions.

↓

Pictures of real objects are used in arriving at solutions.

↓

Drawings of nonrepresentational objects are used in arriving at solutions.

↓

A graphical model is constructed.

↓

A mathematical model is constructed to represent the structure of the relationship.

↓

Algorithms and mathematical processes are applied

↓

A generalized mathematical model is developed for future use.

II. NOTES REGARDING IMPLEMENTATION

1. General

The revised program recognizes that there is a body of mathematical knowledge and skills that must be provided for all students. In addition, provision must be made for students with specific requirements. As a consequence, a two part mathematics program has been planned. The first part, essentially the same for all students, includes the elementary program and extends into the secondary. The second part consists of elective courses selected by the student because of

a) post-secondary goals
b) secondary school program requirements
and c) student interest and ability

Provision has also been made through a multiple-text authorization for alternative subprograms for groups of students. These alternatives allow for differences in approach, depth and rate of learning. The extent to which the inherent benefits are achieved, however, depends in large measure on the resourcefulness of the teacher and the organization of the school.

It is strongly emphasized that no single text be regarded as the sole instrument for meeting the objectives of the mathematics program at any particular level. Various combinations of the authorized texts, along with available supplementary materials may be used to ensure an effective program.

If the program is to be relevant to present needs of students while also providing the foundations for future learning, then mathematics should be integrated with the other subjects. A meaningful integration will go far towards achieving a deep and continuing interest in mathematics and an appreciation for its power and usefulness. The nature and the means of integration will be determined at the school level by the specific programs being offered to the students.

2. Course Outlines, Years 9-10, 11-12:

In each of the levels indicated preliminary drafts of the Course Outlines were included in the Curriculum Guide for one year prior to preparing the final draft. Many comments and constructive criticisms were received from individual teachers and/or groups of teachers from throughout the Province. These comments and criticisms were given careful consideration in the preparation of the final prescription.

3. Computing Science 11

No particular textbook has been prescribed for Computing Science 11. Because of the variety of computer hardware being used, and the variations in course emphasis, a single text would not be practical. A list of possible references for Computing Science 11 is stated in the Appendix. Individual schools or Districts should select the text most suitable for the course being offered. The Computing Science 11 text will be purchased through the local District.

4. Statement of Metrication

The Federal Government has committed Canada to the change to the Metric System. This change will take place over a ten year period and is to be completed by 1981. Commencing in September, 1973, all primary pupils began to use the metric system as a standard of measurement. It has been agreed by the council of Ministers of Education, Canada, that all instruction in elementary and secondary schools be predominently metric by 1978. Mathematics for years K-12 will be completely metric by that date.

It is the intent of the Metric Commission to establish the practice of using spaces rather than commas in the writing of larger numbers (e.g. 746 321 988 rather than 746, 321, 988). However, you will find both forms used in present editions of the prescribed texts. **Spaces are not used in computation.**

The following chart is designed to indicate grade levels at which the various aspects of metric measurement could be introduced. These introductory levels have been suggested after careful consideration by the Mathematics Revision Committee.

GRADE LEVEL	DECIMAL SYSTEM	LINEAR MEASURE	AREA	VOLUME AND CAPACITY	MASS	TIME	TEMP.
1		arbitrary units cm					
2		cm m 100 cm = 1 m		ordering containers by capacity	arbitrary units kg personal mass	h, 1/2 h	
3		km	cm^2 covering 2-D space	cm^3 filling 3-D space ml, litre	kg g balancing	min	C
4	1, 2 place with linear measure	mm 1000 mm = 1 m 1000 m = 1 km	m^2 concrete activities in finding area	m^3 construction to appreciate size	1000 g = 1 kg	24 h clock	
5	+, − of decimals to 3 places	dec. notation sub-multiples eg. 1 mm = 0.001 m etc.	area problems km^2	volume problems solids capacity problems	1 g = 0.001 kg	standard time Canada	
6	all operations with decimal to 3 places rounding off	estimation	estimation ha*	estimation 1 dm^3 = 1 1 m^3 = 1000 l	estimation metric tonne t**	daylight saving time	
7	analysis of total metric system milli → mega with stress upon 3rd powers of 10 milli kilo mega	rate problems km/h			mg	time zones world	

All common Metric Units, multiples and sub-multiples mastered by end of Grade 7.

* 1 hectare = 10 000 m^2 (used for measuring large areas)

** 1 tonne = 1000 kg

goals of mathematics program

III. GOALS

A. General

Stated on the pages following are the cognitive goals generally thought desirable at this time. The learning outcomes listed for each year are prescriptive but are not exhaustive. Teachers are encouraged to formulate learning outcomes for their own situation consistent with those in this guide.

No mention is made here of goals in the affective domain, not because they are less important, but because there is no consensus among educators of what they should be or how they might be achieved. Teachers are encouraged to develop their own specific objectives in this area.

In identifying the major goals of a mathematics program, one must consider that the broad goals of mathematics are derived from the needs of individuals and of society. The practical usefulness of mathematics in our scientific and technological society is increasingly apparent.

With few exceptions, the content of the revised courses in years 1-10 does not differ significantly from the content of previous courses. The emphasis in years 1-10 remains on the operations with natural, whole and rational numbers and the study of their properties. One major exception is an expanded study of geometry. The treatment is largely intuitive though somewhat more formal at the secondary level. Two other exceptions are an introduction to the concept of function and the employment of flow charting.

The courses are organized around 9 "themes" or strands:

I sets and set operation

II number and number operations

III geometry

IV measurement

V problem solving

VI graphs and functions

VII applications of mathematics

VIII logical thinking

IX probability and statistics

The development of a course, however, does not follow a single strand exclusively but must draw on several strands at once.

B. Major Cognitive Goals: The mathematics program will enable the student:

1. to identify and use the basic properties and operations of the real number system;
2. to identify common geometric figures and demonstrate a knowledge of their basic properties;
3. to transform given numerical and algebraic expressions into equivalent expressions;
4. to solve open sentences of various types and degrees of complexity;
5. to apply knowledge of mathematics to familiar physical or environmental situations in order to construct a descriptive mathematical model of the situation or to solve a problem arising from the situation.

C. Student Evaluation

The major purpose of evaluation is to guide students in their learning. Evaluation determines the extent to which the learning outcomes have been achieved. It should serve to improve educational decision making and to redirect learning. In a general guide such as this, it is not possible to indicate the level of competence to be met by each student at a given time. However, data from various tests, interviews, and checklists based on observations of student performance can facilitate better teaching and learning.

Some approaches to evaluation might include:

1. pre-testing to determine student knowledge, skills, and attitudes at the beginning of a unit. This may enable the instructional program to be tailored more closely to the needs of the individual or of the group.

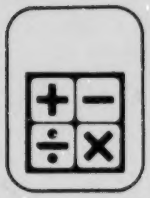
2. continuing or ongoing evaluation enabling students to assess their progress and teachers to diagnose weaknesses and alter methods and materials accordingly.

3. evaluation at the conclusion of a unit enabling the teacher to determine the degree to which outcomes have been achieved and to assess the overall effectiveness of the instructional program.

Students do not learn at the same rate. Consequently, as school organizational patterns permit, a continuous progress program of some kind should be favored. In such a scheme, each teacher must take full responsibility for his/her students by determining their initial level of competence and then helping them progress.

The evaluation program should provide students with concrete information about their progress, enable teachers to plan and redirect programs based on factual information, and provide parents with a clear statement of what students are learning.

mathematics years 1-2 and 3 learning outcomes



Note: ● This symbol indicates the Learning Outcomes which are considered to be core or basic to the development of the mathematics program.

LEARNING OUTCOMES

(1) Years 1, 2, and 3

During YEAR ONE the student:

- 1. Compares sets through matching and relates number symbols to real objects.
- 2. Determines if the number of a set is equal or not equal to the number of another set
- 3. Determines cardinal number of a set to 10
- 4. Reads and writes numerals to 10
- 5. Orders numbers on a number line
- 6. Solves addition equations and recognizes that addition is commutative: $a + b = b + a$
- 7. Solves addition and subtraction equations, and recognizes that addition and subtraction are inverse operations:
  $a + b = c$, $c - a = b$, $c - b = a$
- 8. Uses additive identity with numbers to 10: $a + 0 = a$
- 9. Relates multiplication to repeated addition using products to 10
- 10. Divides orally to 10 (Finding equal subsets and sharing).
- 11. Renames numbers to 10
- 12. Uses ordinals to tenth
- 13. Solves simple problems involving addition and subtraction
- 14. Is able to group by tens and ones and relate this to place value
- 15. Reads and writes numerals to 99
- 16. Counts by 1's to 99
- 17. Recognizes and uses symbols $=, \neq, >, <, +, -, \times$, and $\square$
- 18. Recalls with reasonable speed and accuracy the addition, subtraction, and multiplication facts to 10
- 19. Uses fraction ideas in sharing activities with concrete materials.
- 20. Classifies geometric shapes (informal — can, ball, box, etc.)
- 21. Uses terms faces, edges and corners when examining three dimensional objects
- 22. Uses arbitrary units (hand, foot, block,) and the standard unit (centimetre) to measure and compare lengths
- 23. Reads the clock to tell time on the hour
- 24. Uses meaningfully the vocabulary of comparison and position (e.g. larger, most, heavier, in front of, etc.)

During YEAR TWO the student:

- 1. Recognizes and uses symbols from Year One, and also $\div$, ¢, and ( )
- 2. Solves addition equations including concepts of commutativity, $a + b = b + a$, and associativity, $(a + b) + c = a + (b + c)$, using sums to 18
- 3. Solves addition and subtraction equations including concept of inverse operations:
  $a + b = c$, $c - a = b$, $c - b = a$
- 4. Uses additive identity ($a + 0 = a$) with numbers to 20
- 5. Relates multiplication to repeated addition; products to 20
- 6. Solves multiplication and division equations for products to 20, including concept of inverse operations:
  $a \times b = c$, $c \div a = b$, $c \div b = a$

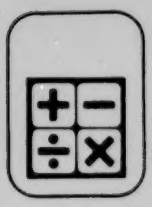
- 7. Solves multiplication equations including concepts of identity, $a \times 1 = a$, and commutativity, $a \times b = b \times a$, with products to 20
- 8. Translates a word problem into mathematical symbols and solves using appropriate operations (addition and subtraction)
- 9. Uses ordinals to twentieth
- 10. Reads and writes numerals to 999
- 11. Understands the place value of numerals to 999
- 12. Uses expanded notation to rename numbers to 999
- 13. Uses the number line for order, skip-counting and operations
- 14. Skip counts by 2's, 5's, and 10's
- 15. Recalls with reasonable speed and accuracy the addition and subtraction facts to 18
- 16. Recalls with reasonable speed and accuracy the multiplication and division facts to 20
- 17. Solves problems involving pennies, nickels, dimes and quarters. Uses ¢ symbol
- 18. Identifies odd and even numbers to 20
- 19. Identifies 1/2, 1/3, 1/4, (unit fractions) of objects and sets
- 20. Solves addition and subtraction examples with 2 or 3 digit numerals without regrouping
- 21. Solves addition and subtraction equations with regrouping (89 + 6, 82 − 7)
- 22. Traces faces of solids and recognizes and names plane figures (circle, square, rectangle, triangle)
- 23. Uses plane shapes in pattern making
- 24. Folds and traces to gain informal experience with symmetry
- 25. Classifies solids according to faces, edges and vertices
- 26. Estimates and measures length in arbitrary units, centimetres, and metres
- 27. Measures capacity in arbitrary units
- 28. Reads the clock and tells time by the hour and half hour
- 29. Measures personal mass in kilograms

During YEAR THREE the student:

- 1. Recognizes and uses necessary symbols from year two, and also $\sqrt{\ }$, $
- 2. Reads and writes numerals to 9999
- 3. Uses expanded notation in renaming numbers to 9999
- 4. Understands the place value of numerals to 9999
- 5. Solves addition and subtraction examples with 2, 3, and 4 digit numerals, with and without regrouping
- 6. Solves multiplication examples including:
  - a) the zero principle: $a \times 0 = 0$
  - b) the identity principle: $a \times 1 = a$
  - c) the commutative principle: $a \times b = b \times a$
  - d) the associative principle: $(a \times b) \times c = a \times (b \times c)$
  - e) the distributive principle: $a \times (b + c) = (a \times b) + (a \times c)$ for products to 50
- 7. Solves division examples with and without remainders using sets and the number line
- 8. Recalls with reasonable speed and accuracy the multiplication and division facts to 50
- 9. Translates a word problem into mathematical symbols and solves using appropriate operations
- 10. Recognizes and uses correctly the following terms: odd, even, product, sum, difference, remainder

11. Identifies unit fractions of objects and sets. Reads and writes equations using these fraction names
12. Multiplies by 10 and 100
13. Is able to round off numbers to nearest 10 or 100
- 14. Constructs simple geometric models of solids and plane shapes
15. Recognizes axis of symmetry from experiences with concrete materials
- 16. Uses graphs as a means of recording
- 17. Estimates and measures length in arbitrary and metric units to kilometres
- 18. Estimates and measures capacity in arbitrary and metric units in ml and litres
- 19. Determines area by covering 2-D spaces with cm^2
- 20. Determines volume by filling 3-D spaces with cm^3
- 21. Determines mass by balancing in kilograms and grams
- 22. Reads the clock to tell time and records in the conventional way (2:45)
- 23. Recognizes the division of units of time into years, months, weeks, days and hours
24. Reads and writes Roman Numerals to 12
25. Skip counts by 2's, 3's, 5's, 10's
- 26. Reads thermometer in °C

mathematics years 4-5 and 6 learning outcomes



(2) Years 4, 5 and 6

YEAR 4	YEAR 5	YEAR 6	I. NUMBER, NUMERALS & NUMBER OPERATIONS
			The Student Is Able To:
to 100 000	thru millions	thru billions	● 1. Read and write whole numbers in standard notation.
to 100 000	thru millions	thru billions	● 2. Indicate place value of each digit of a numeral in standard notation.
to 100 000	thru millions	thru billions	● 3. Write numbers in expanded notation.
to 12	to 100	to 1000	● 4. Read and write whole numbers in Roman notation.
by 2's, 3's, 4's, 5's and 10	by 6's, 7's, 8's and 9	*	● 5. Count.
*	*	*	6. Regroup as required for algorithms
			● 7. Identify sets of:
*	*	*	a) whole numbers
*	*	*	b) even whole numbers
*	*	*	c) odd whole numbers
–	*	*	d) prime numbers
1/2, 1/3, 1/4, 2/3, 3/4,	*	*	e) equivalent fractions
–	–	*	f) rational numbers
*	*	*	● 8. Recognize and use factors as terms in multiplication
*	*	*	● 9. Express a number as the product of two or more factors.
–	*	*	● 10. Express a number as a product of its prime factors.
–	–	*	● 11. Determine the highest common factor of two or more numbers.
*	*	*	● 12. Recognize products as answers in multiplication.
*	*	*	● 13. Recognize products as multiples of a given whole number.
–	–	*	14. Determine the LCM of two or more numbers.
*	*	*	● 15. Use the concepts of a fractional number as:
			a) part of a whole
			b) part of a group

* Is introduced or is being continued.

– Has not been introduced at this level or is discontinued.

YEAR 4	YEAR 5	YEAR 6	NUMBER, NUMERALS & NUMBER OPERATIONS (Cont'd)
			16. Use the terms listed below in discussion and explanation of fractional processes.
*	*	*	a) numerator
*	*	*	b) denominator
*	*	*	c) like fractions
–	*	*	d) unlike fractions
–	*	*	e) proper fractions
–	*	*	f) improper fractions
–	*	*	g) mixed numbers
–	*	*	h) lowest terms
to 100ths	to 1000ths	to 10 000ths	• 17. Write decimal numerals for numbers.
*	*	*	• 18. Use the properties of associativity and commutativity as applied to addition and multiplication. (no emphasis on terminology)
			• 19. Use the addition algorithm to solve examples in:
*	*	*	a) addition of whole numbers
			b) addition of common fractions
*	*	*	i. like fractions
–	*	*	ii. unlike fractions
–	*	*	c) addition of mixed numbers
$	to 1000ths	to 10 000ths	d) addition of decimal fractions
*	*	*	e) column addition
*	*	*	• 20. Use the property of distributivity of multiplication over addition. (no emphasis on terminology)
*	*	*	• 21. Correctly indicate the products — basic facts to 81.
			• 22. Use the multiplication algorithm to solve examples in:
2-figure multipliers	*	*	a) multiplication of whole numbers
–	*	*	b) multiplication of common fractions
–	–	*	c) multiplication of mixed numbers
$ With whole number multipliers	dec. to 1000th × whole no.	all	d) multiplication of decimal fractions
			• 23. Explain multiplication in terms of:
*	*	*	a) repeated addition
*	*	*	b) arrays
*	*	*	c) intersections

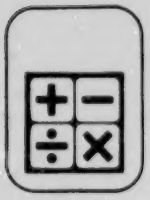
YEAR 4	YEAR 5	YEAR 6	NUMBER, NUMERALS & NUMBER OPERATIONS (Cont'd)
			● 24. Explain subtraction in terms of:
*	*	*	a) separation of sets
*	*	*	b) inverse of addition
			● 25. Use the subtraction algorithm to solve examples in:
*	*	*	a) subtraction of whole numbers involving regrouping
			b) subtraction of common fractions
*	*	*	i. like fractions
–	*	*	ii. unlike fractions
–	*	*	c) subtraction of mixed numbers involving regrouping
$	to 100ths	to 10 000ths	d) subtraction of decimal fractions
*	*	*	● 26. Correctly indicate quotients — basic facts to 81.
			● 27. Explain division in terms of:
*	*	*	a) repeated subtraction of groups of equal size
*	*	*	b) the inverse of multiplication
1-figure divisors	–	–	28A. Use repeated subtraction to solve examples in division of whole numbers.
–	*rem. as fractions	*	● 28B. Use the traditional division algorithm to solve examples in division of whole numbers.
–	–	*	● 29. Solve examples involving division of common fractions and mixed numbers.
whole $\sqrt{}$ number $	whole $\sqrt{}$ number $	all	● 30. Solve examples involving division of decimal fractions.
–	*	*	● 31. Compare the number of elements in 2 sets as a ratio.
–	–	*	● 32. Express 2 equivalent ratios in the form of a proportion. Express 2 equivalent rates in the form of a proportion.
			● 33. Express scores or other data:
–	*	*	a) as a ratio
–	*	*	b) as an equivalent ratio with 100 as the second term
–	–	*	c) as a percent fraction

YEAR 4	YEAR 5	YEAR 6	II. SETS AND SET OPERATIONS
*	*	*	34. Use the term "set" in describing and classifying groups of objects and numbers.
			III. GEOMETRY
*	*	*	● 35. Identify and list properties of common 3-D geometrical forms; cube, prism, cylinder, cone, tetrahedron, pyramid, sphere.
*	*	*	36. Construct common 3-D geometrical forms from nets (excluding sphere)
			● 37. Identify and list properties of common 2-D geometrical shapes.
*	*	*	a) triangle
*	*	*	b) rectangle
*	*	*	c) square
–	–	*	d) quadrilateral
–	–	*	e) parallelogram
–	–	*	f) trapezoid
–	–	*	g) pentagon
–	–	*	h) hexagon
–	–	*	i) octagon
centre circumference	diameter	radius chord	● 38. Identify the circle and its parts.
			39. Give examples from the physical world which approximate:
*	*	*	a) the point
*	*	*	b) the line
*	*	*	c) the plane
			● 40. Use the vocabulary of lines.
*	*	*	a) intersecting lines
–	*	*	b) parallel lines
–	*	*	c) perpendicular lines and right angles
–	*	*	d) horizontal and vertical
*	*	*	41. Perform experiments involving translations, reflections, rotations and flips.

YEAR 4	YEAR 5	YEAR 6	GEOMETRY (Continued)
*	*	*	42. Perform investigations and arrive at conclusions related to tiling (tessellations).
*	*	*	43. Discuss symmetry, with respect to axes and points.
			IV. MEASUREMENT
			• 44. Use instruments to measure the following (arbitrary, metric)
mm cm m km	*	*	a) length
cm^2 m^2	km^2	ha	b) surface
cm^3 m^3	*	dm^3	c) volume
l ml	*	*	d) capacity
g kg	*	tonne	e) mass
to 100ths	to 1000ths	*	• 45. Use decimal notation with metric measures.
24 h clock sec, min, h, d, wk, mo, yr	Standard time	Daylight time century	• 46. Use appropriate units to measure a) time
Celsius	*	*	b) temperature
*	*	*	• 47. Estimate and measure distances, areas, volumes, capacities, masses, using the units specified for the grade.
*	*	*	48. Round off measures to the nearest unit.

YEAR 4	YEAR 5	YEAR 6	V. PROBLEM SOLVING
*	*	*	• 49. Analyze and write open sentences for situation problems and word problems.
*	*	*	• 50. Construct models or diagrams to aid in problem solution.
*	*	*	• 51. Estimate answers and check for appropriateness of answers obtained.
*	*	*	52. Re-state problems in his own words.
*	*	*	53. Construct word problems arising out of investigations.
*	*	*	• 54. Use alternate methods of problem solution.
–	–	*	• 55. Express appropriate problem as an open sentence in the form of a proportion (two equal ratios) and solve.
			VI. GRAPHS
			• 56. Interpret:
*	*	*	a) concrete graphs
*	*	*	b) pictographs
*	*	*	c) bar graphs
*	*	*	d) line graphs
			e) circle graphs
			• 57. Construct:
*	*	*	a) concrete graphs
*	*	*	b) pictographs
–	–	*	c) bar graphs
–	–	*	d) line graphs
–	–	*	58. Make simple scale drawings of rectangular regions.

mathematics years 7 and 8 learning outcomes



LEARNING OUTCOMES

(3) Years 7 and 8

I. SETS AND SET OPERATIONS

7 8 The student is able to:

● 1. use the following symbols
x x a) {a, b, c, . . .}
x b) $\in$ Φ $\subset$ $\cap$ $\cup$

x x 2. state or demonstrate whether two sets are in one-to-one correspondence;

x x 3. specify the elements of a set when given a word description of the set;

x x 4. specify, draw, or state
a) the union of two or more sets
b) the intersection of two or more sets.

II. NUMBER AND NUMBER OPERATIONS

A. Notation

The student is able to:

x x ● 1. distinguish between the concepts of number and numeral;

x x ● 2. state the value represented by each digit in a multi-digit decimal numeral;

x x ● 3. write decimal numerals in expanded form using
a) powers of ten
b) powers of ten in exponent form;

x x ● 4. use the common mathematical symbols;

x ● 5. write decimal numerals in scientific notation.

B. Number

The student is able to:

● 1. identify the elements belonging to the following sets of numbers:
x x a) natural or counting numbers
x x b) whole numbers
x x c) rational numbers
x d) integers
x e) irrational numbers
x f) real numbers

2. describe the relationship between the sets of numbers listed above in terms of union and intersection;

x x ● 3. list the factors of a number;

x ● 4. list the multiples of a number;

x x 5. identify the elements belonging to specified sets of numbers: (e.g. prime numbers, even numbers, odd numbers, etc.).

C. Operations

7 8 The student is able to:

		●	1.	perform the operations of addition, subtraction, multiplication and division with:
x	x			a) whole numbers
x	x			b) rational numbers in
				i. fraction form
				ii. decimal form
				iii. mixed numeral form
	x			c) integers;
x	x	●	2.	round a decimal numeral to a specified place value;
x	x		3.	perform sight multiplication and division with powers of ten;
x	x	●	4.	write a whole number as a product of its prime factors;
x	x		5.	calculate the G.C.F. of two or more whole numbers;
x	x		6.	calculate the L.C.M. of two or more whole numbers;
x	x		7.	write sets of equivalent fractions;
x	x		8.	write an improper fraction for a mixed numeral and conversely;
x	x	●	9.	write a decimal numeral for a fraction numeral;
x	x	●	10.	write a fraction numeral for a decimal numeral;
x	x	●	11.	write a percent numeral for a fraction numeral or a decimal numeral;
	x		12.	use a table to find the approximate square root of a number;
x	x	●	13.	perform, in conventional order, a calculation involving a series of operations;
x	x	●	14.	solve simple open sentences.

D. Principles

The student is able to:

		1. recognize and use the following principles:
x	x	a) commutative for addition and multiplication
x	x	b) associative for addition and multiplication
x	x	c) distributive
x	x	d) addition of zero
x	x	e) multiplication by one
x	x	f) reciprocals (e.g. $x \cdot \frac{1}{x} = 1 \rightarrow 3 \cdot \frac{1}{3} = 1$)
	x	g) opposites (e.g. $x + -x^{x} = 0 \rightarrow 5 + -5 = 0$)
	x	h) subtraction (e.g. $x - y = x + -y \rightarrow 7 - 13 = 7 + -13$).

III. GEOMETRY

7	8		
			The student is able to:
		● 1.	describe or give the meaning for the concept of congruency for:
x	x		a) segments
x	x		b) angles
	x		c) triangles;
		● 2.	use compass and straight-edge to:
x	x		a) copy an angle
x	x		b) bisect an angle
x	x		c) bisect a segment
	x		d) construct a perpendicular to a line at a point on a line
	x		e) construct a perpendicular to a line from a point not on the line
	x		f) construct a parallel to a line through a given point
	x		g) copy a triangle or construct a triangle to specifications;
		● 3.	identify from a diagram, or draw a diagram illustrating:
	x		a) adjacent angles
	x		b) complementary angles
	x		c) supplementary angles
	x		d) vertical angles
x	x		e) obtuse angles
x	x		f) right angles
x	x		g) acute angles
	x		h) isosceles triangles
	x		i) equilateral triangles
	x		j) scalene triangles
x	x		k) right triangles
x	x		l) parallel lines
	x		m) altitudes of triangles
x	x		n) quadrilaterals
x	x		i) parallelograms
x	x		ii) rectangles
x	x		iii) squares
x	x		q) parts of a circle;
	x	● 4.	calculate the measure of an angle of a triangle given the measures of the other two angles;
	x	● 5.	use the Pythagorean Theorem to calculate any side of right triangles.

IV. MEASUREMENT

7	8		
			The student is able to:
x	x	● 1.	describe the steps involved in the measurement process: namely a) choosing a unit b) dividing the object to be measured into the specific units c) counting the number of units used;
x	x	● 2.	use a ruler to measure length in British and metric units; (emphasis on metric units)
x	x	● 3.	use a protractor to measure angles;
x	x	4.	state and use the British and metric units of a) length b) angular measure c) area d) volume;
x	x	● 5	perform the basic arithmetic operations using units of measure.

V. PROBLEM SOLVING

The student is able to:

x	x	1.	analyze a verbal problem and a) distinguish between what is given and what is to be found b) recognize whether sufficient information is given to solve the problem c) determine what operations are required to solve the problem;
x	x	● 2.	construct a "model" such as a diagram as an aid to solving a problem;
x	x	3.	translate verbal problems into open sentences;
x	x	4.	construct a flow chart to fit a verbal description of an operation or procedure;
x	x	● 5.	test the appropriateness of an answer to a problem.

VI. GRAPHS AND FUNCTIONS

The student is able to:

x	x	1.	calculate the output number when given input numbers and a function rule;
		● 2.	graph on a number line:
x	x		a) whole numbers
x	x		b) integers
x	x		c) rational numbers in i) fraction form ii) decimal form
x	x	3.	graph the solution set of an open sentence on the number line.

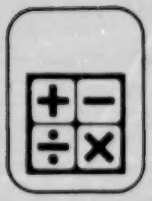
VII. APPLICATIONS OF MATHEMATICS

7	8		
			The student is able to:
x	x	● 1.	draw or interpret scale diagrams;
x	x	● 2.	solve problems involving percent, (e.g. interest, discount, sales tax, etc.);
		● 3.	calculate perimeters and areas of:
x	x		a) rectangles
x	x		b) triangles
	x		c) circles
	x		d) parallelograms
	x		e) other polygons;
		● 4.	calculate volumes of:
x	x		a) rectangular prisms
	x		b) cylinders.

VIII. LOGICAL THINKING

			The student is able to:
	x	1.	solve open sentences involving the connectives "and" and "or".

mathematics years 9 and 10 learning outcomes



(4) Mathematics 9 and 10

The content of Years 9 and 10 is an extension of the program undertaken to the end of Year 8 and continues to be based on the premise that a broad mathematical education is necessary for every person in order that he/she be able to understand the world of today and of the future.

The structure of the program in Years 9 and 10 also continues the pattern developed in earlier years in that each course has specified learning outcomes and a multiple-text authorization. It will be obvious that many of the objectives listed below will have been encountered previously by many students, and that additional objectives will be necessary for certain other students. It bears repeating, therefore, that the learning outcomes listed are intended as a guide and must be amended by the teacher to meet particular circumstances.

ORGANIZATION

The learning outcomes are categorized as Core (C), Level 1 (1), and Level 2 (2); those items that are largely review of material covered in previous courses are marked with an (R).

In general most students will be expected to take those sections marked "core" in algebra, geometry, consumer mathematics and where appropriate, industrial and trade mathematics. However, for some students it may be appropriate or necessary to modify the core material to suit their interests and abilities. (For example, basic algebra and geometry may be studied as it applies in consumer mathematics and/or industrial and trades mathematics.)

This material would be studied at varying degrees of sophistication. In addition, the more able students would be expected to study the sections marked 'level 1 and level 2'.

Level 1 enrichment would suggest exploration of a topic beyond the "core" level for the average interested student. Level 2 enrichment suggests a more intensive exploration of a topic by more capable students who will likely be continuing in a mathematics or science specialty.

It is not expected that the core material will occupy all students for a full two-year period. Therefore, opportunities exist for students to explore other areas of mathematics. e.g. Probability, Statistics, Computing Science.

Some of the optional topics (probability, statistics, computer science) may provide a basis for the introduction of locally developed courses which some schools may wish to offer in addition to the suggested program.

LEARNING OUTCOMES

1. Algebra

R	9	10			
					A. NUMBER AND NUMBER OPERATIONS
					The student is able to:
R	C	C	●	1.	perform with increasing accuracy the basic operations of arithmetic with the rational numbers;
R	C	C	●	2.	round-off a decimal numeral to a specified place value;
R	C	C	●	3.	change a decimal numeral to a percent and conversely;
R	C	C	●	4.	change a fractional numeral to a percent and conversely;
R	C	C	●	5.	change a decimal numeral to a fractional equivalent and conversely;
	–	1		6.	distinguish between rational and irrational numbers by their decimal forms;
R	C	C	●	7.	convert numerals written in usual notation to scientific notation and conversely;
	1	C		8.	calculate products and quotients using scientific notation;
R	C	C	●	9.	use the axioms of the real numbers (closure, commutative, associative, distributive, etc.) to simplify an algebraic expression or to solve an open sentence;
	2	2		10.	identify the axioms of the real numbers as illustrated by given statements;
R	C	C		11.	write a given positive integer as the product of its prime factors;
	–	C		12.	round-off a numeral to a specified accuracy in terms of significant digits.
					B. POLYNOMIAL EXPRESSIONS
					The student is able to:
	C	C	●	1.	use the laws of exponents in simplifying expressions with integral exponents;
	C	C	●	2.	evaluate an algebraic expression or formula for given values for the variables;
	C	C	●	3.	add and multiply polynomials and apply these operations to: a) simplifying expressions b) solving open sentences;
	C	C	●	4.	divide a given polynomial by a monomial;
	2	2		5.	divide a given polynomial by a (linear) binomial;
	C	C	●	6.	find the greatest common factor of two or more monomials;
	C	C	●	7.	given a monomial and one of its factors, find the other factor;

R	9	10			
	C	C	●	8.	given a polynomial containing a common monomial factor, write the polynomial in factored form;
	–	1		9.	factor certain polynomials by grouping terms;
	1	C		10.	given a binomial that is the difference of two squares, write it in factored form;
	1	C		11.	write the square of any binomial as a trinomial;
	1	C		12.	write (at sight) the terms in the product of two binomials;
	1	C		13.	factor a quadratic trinomial;
	2	2		14.	factor a given polynomial product by combining several types of factoring.

C. SOLUTION OF OPEN SENTENCES

The student is able to:

				1.	solve open sentences:
R	C	C	●		a) simple equations
	C	C	●		b) simple inequalities
					c) quadratic equations
	–	C			i. by formula
	–	C			ii. by factoring
					d) systems of linear equations
	–	1			i. by graphing
	–	1			ii. algebraically
	–	1			e) linear inequalities by graphing on the number line
	–	2			f) radical equations
	2	1		2.	given an equation containing two or more variables, solve the equation for one of the variables in terms of the others;
	2	2		3.	perform the operations of union and intersection in the graphing of, or the finding of, the solution sets of compound open sentences.

D. PROBLEM SOLVING

The student is able to:

	C	C	●	1.	translate an English phrase or sentence into an algebraic expression or open sentence;
	C-2	C-2	●	2.	solve word or "story" problems algebraically (including ratio and proportion).

E. GRAPHING RELATIONS

The student is able to:

	C	C	●	1.	given a table or a list of ordered number pairs, plot a graph;
	C	C	●	2.	given an equation in two variables, graph the equation in the coordinate plane;

R	9	10		
	–	2		3. given the graph of a relation, or its open sentence, indicate the domain and range of the relation and determine whether the relation is a function;
	–	2		4. given a linear inequality, construct its graph

F. RADICAL EXPRESSIONS

The student is able to:

C	C	●	1. find the square root of perfect squares of numbers and monomials by factoring;
C	C	●	2. use a table to find the square and square root of a number;
–	1		3. write square root radical expressions in simplest form.

2. Geometry

A. PARALLEL LINE

The student is able to:

C	C	●	1. determine from a given diagram whether two or more lines cut by a transversal are parallel using one of the following properties: a) corresponding angles b) alternate angles c) sum of the interior angles
C	C	●	2. determine from a given diagram the measure of specified angles when the diagram embodies parallel lines cut by a transversal.

B. PYTHAGOREAN THEOREM

The student is able to:

		●	1. calculate one side of a right-angled triangle given the other two, the result being expressed in: a) numerical form b) simplest radical form
R	C	C	
	–	1	
	–	1	2. state and use as required the ratio of the sides of the: a) 30° - 60° - 90° triangle b) 45° - 45° - 90° triangle

C. CIRCLE

The student is able to:

C	C	●	1. identify from a diagram or draw a diagram illustrating the parts of a circle: centre, chord, diameter, radius, central angle, sector, segment;
	–	C	2. determine from a given diagram the measures of specified segments, arcs or angles using one or more of the following properties: a) the centre of a circle lies on the perpendicular bisector of a chord,

R	9	10		b) a tangent is perpendicular to a radius at its point of contact, c) two tangents to a circle from an external point are equal and make equal angles with the line joining that point to the centre, d) inscribed angles of a circle subtended by the same chord are equal, e) inscribed angles of a semi-circle are right angles, f) the central angle of a circle is twice the inscribed angle subtended by the same arc;
	2	C	3.	make the following constructions: a) locate the centre of a given circle, b) draw a tangent to a given circle from a point outside the circle, c) circumscribe a circle about a triangle, d) inscribe a circle in a triangle.

D. SIMILAR FIGURES

The student is able to:

	C	C	1.	determine whether two triangles are similar;
	C	C	2.	calculate a side of one of two similar triangles;
	–	C	3.	specify the sine, cosine and tangent of an acute angle as the ratio of two sides of a right triangle;
	–	1	4.	determine the trigonometric values of 30°, 45°, 60° by applying the definitions of sine, cosine, and tangent and the Pythagorean Theorem;
	–	C	5.	use trigonometric tables to find the trigonometric values of an acute angle and conversely;
	–	1	6.	use trigonometry and the Pythagorean Theorem to solve right triangles and problems involving triangles;
	–	C	7.	make and read scale drawings.

E. SYMMETRY

The properties of symmetry should be used where helpful.

F. MEASUREMENT

The student is able to:

R	C	C	1.	calculate the prerimeter of a: a) polygon, given its sides b) circle, given its radius or diameter c) composite figure, given the appropriate measures;
	C	C	2.	calculate the area of a:
R				a) triangle
R				b) rectangle
				c) parallelogram (given the formula)
				d) trapezoid (given the formula)
R				e) circle

R 9 10

f) sector (given the formula)
g) composite figure (e.g. regular polygon, ring);

C C ● 3. given the formula, calculate the surface area of a:
a) rectangular prism
b) triangular prism
c) cylinder
d) cone
e) pyramid
f) sphere

C C ● 4. given the formula, calculate the volume of a:
R a) rectangular prism
b) triangular prism
R c) cylinder
d) cone
e) pyramid
f) sphere

C C ● 5. determine from a given diagram the measure of specified angles when the diagram embodies one or more of the following:
a) equilateral triangles
b) isosceles triangles
c) parallelograms
d) right angles (complementary angles)
e) straight angles (supplementary angles)
f) see 2. A (2) — Parallel Lines.

G. VECTORS

The student is able to:

– C 1. distinguish between vector and scalar quantities;

– C 2. construct a scaled vector diagram to represent a situation described in words;

– C 3. calculate the resultant vector for two given vectors by a scale diagram.

3. Consumer Mathematics

A. SIMPLE INTEREST

The student is able to:

C ● 1. use the concept of simple interest in calculations of discount, commission, profit and loss, payroll, insurance premiums, property taxes, etc.,

C ● 2. determine:
a) from a table, or
b) by counting or calculation the number of days in parts of a year;

C ● 3. calculate present value and future amount.

B. COMPOUND INTEREST

The student is able to:

–	C	•	1.	explain the meaning of compound interest;
–	C	•	2.	calculate the number of interest periods in a given length of time;
–	C	•	3.	calculate bank interest.

C. ANNUITIES

The student is able to:

–	1		1.	explain the nature of annuities, (those in which the interest period = payment period) as exemplified in: a) mortgage payments b) installment buying c) charge accounts
–	C	•	2.	calculate the true rate of interest in installment payments when given the formula.

D. FURTHER TOPICS

Topics may be selected from the following:

–	C	1.	Owning an automobile
–	C	2.	Insurance
–	1	3.	Borrowing, saving and investing money
–	C	4.	Earning money and payroll
–	1	5.	Taxes — income, property, sales.

4. Industrial and Trades Mathematics

Topics may be selected from the following:

1. Power and energy
2. Construction
3. Manufacturing
4. Graphic Arts

OPTIONAL TOPICS

5. Probability

Simple probability may be introduced if desired.

6. Statistics

The student is able to:

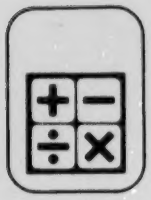
1. organize given data into a frequency distribution;
2. represent given data in graphical form;
3. find for given data:
   a) the mean
   b) the median
   c) the mode
4. calculate the standard deviation for given data.

7. Computing Science

The student is able to:

1. give a description of the function of each of the major components (input, control, processor, memory, output) of a digital computer;
2. use elementary BASIC as a programming language to write, execute and debug simple programs (where facilites are available).
3. operate "hands-on" a computer system and/or a remote terminal (where facilities are available).
4. construct or read a flow chart for a procedure, algorithm or program.

mathematics years 11 and 12 learning outcomes



EXPLANATORY NOTES

(5) Mathematics: Years 11 and 12

The mathematics courses up to and including Mathematics 10 have been designed on the premise that a broad mathematical education is necessary for everyone. These courses, particularly those at 9 and 10 levels outline mathematical skills, which may be taught at varying levels of sophistication, but which are considered essential for all students. Opportunity is also provided for students to gain experience in how mathematics may be applied to a variety of career and consumer related areas. In addition, provision is made for able and interested students to begin a more formal study of algebra.

At the Year 11 and 12 level, schools, through a selection from the variety of alternative courses available, will be able to provide students with an opportunity to study interest areas in some depth. While these courses deal with particular aspects or applications of mathematics, each has been designed as a resource course. That is, a common set of learnings has been identified for each course and, as well, provision is made for enrichment and for the study of optional interest areas.

For the school year 1976-77, the following courses were available on a permissive basis: Consumer Mathematics 11, Trades Mathematics 11, Algebra 11 and, in the second semester, Algebra 12. For the 1977-78 school year, the following courses will be available for implementation: Computing Science 11, Probability and Statistics 12, and Geometry 12.

Note Re Scholarship Examinations

During the permissive implementation period for the new 11 and 12 level courses, 1976-77 and 1977-78, students, depending upon the course they are taking, will have the opportunity of writing a scholarship examination in Mathematics 12, (presently prescribed program), or Algebra 12, (new program). The first examination in Algebra 12 will be available in June, 1977. The scholarship examination in Algebra 12 will be based upon the prescribed core of the honors format of the course.

ALGEBRA 11 AND ALGEBRA 12

Algebra 11 and Algebra 12 have been designed as a preparatory two course sequence for students intending to take further study in mathematics at post-secondary institutions. The courses are intended to provide students with the opportunity to acquire facility in the techniques of algebra, analytic geometry and trigonometry. In preparing the courses, it was assumed that only students who have achieved at a satisfactory level in the "core" program of the Mathematics 10 course, particularly the appropriate algebraic skills, will elect to take Algebra 11 and, subsequently, Algebra 12.

The two course sequence is outlined both "regular" and "honors" formats. The regular program has been developed anticipating that approximately 200 hours of instruction will be available for the two courses. The honors program will normally require 250 hours of instruction.

While Algebra 11 has been designed as an integral part of a two course sequence, it can be considered as a self-contained course. It is recommended that Algebra 11 be taken prior to (or in special circumstances concurrently with) any mathematics course numbered 12.

Legend: (UAA) Using Advanced Algebra (Doubleday) (MMW 1112) Mathematics for a Modern World 1112 (Gage)
(PCM) Pre-Calculus Mathematics (Merrill)

ALGEBRA 11 (REGULAR FORMAT)

COURSE CONTENT TOPIC	The student is able to develop an understanding of, and an ability to perform the required operations for each topic:	PRESCRIBED	REMARKS
I. Linear Sentences	Linear equations and inequalities. Compound sentences. Linear equations and inequalities in two variables. Slope intercept form. Problems.	1. UAA Ch. 2, pp. 34-69 2. MMW 1112 see units 6, 7 & 9.	1. Topics 1-3 is largely review
II. Polynomials	Adding & subtracting polynomials. Multiplying polynomials. Factoring polynomials. Dividing polynomials.	1. UAA Ch. 3, pp. 71-111 2. MMW 1112 units 2 & 3	
III. Rational Expressions	Laws of Exponents. Multiplying & dividing. Adding & subtracting. Rational expressions in equations. Problems.	1. UAA Ch. 4, pp. 115-150 2. MMW 1112 units 4.1, 4.2, 8.	
IV. Extending the Number System	Roots. Irrational numbers. Operations with radicals.	1. UAA Ch. 5, pp. 152-175 2. MMW 1112 unit 5	
V. Systems of Linear Sentences	Solving systems. Problems. Graphing systems of linear inequalities.	1. UAA Ch. 6, pp. 196-210 & 218-222 2. MMW 1112 units 7 & 8	2. Linear systems in 3 variables is enrichment.
VI. Relations and Functions	Specifying relations and functions Linear functions. Direct variation. Inverse relations. Some graphing techniques: a. horizontal & vertical translations b. dilations c. reflections	1. UAA Ch. 7, pp. 224-263 2. MMW 1112 units 9 & 10 (see remarks.)	3. Graphing techniques (not in MMW 1112)

ALGEBRA 11 (REGULAR FORMAT) (continued)

COURSE CONTENT TOPIC		PRESCRIBED	REMARKS
VII. Quadratic Sentences	Graphing quadratic functions. Maximum and minimum. Solving quadratic equations. Problems. Radical equations. Quadratic inequalities.	1. UAA Ch. 8, pp. 269-288 & 292-305 2. MMW 1112 units 4.3 through 4.6 units 13.4 through 13.7	4. Radical equations (not in MMW 1112)
VIII. Trigonometry	Angles and their measure. The six trigonometric functions and their graphs. Table of values of trigonometric functions. Solving right triangles.	1. UAA Ch. 12, pp. 427-445 2. MMW 1112 units 16 through 20.2	

ALGEBRA 11 (HONORS FORMAT)

COURSE CONTENT TOPIC	The student is able to develop an understanding of, and an ability to perform the required operations for each topic:	PRESCRIBED	REMARKS
I. Linear Sentences	Linear Equations and inequalities. Compound sentences. Linear equations and inequalities in two variables. Slope and intercept form. Problems.	UAA Ch. 2, pp. 34-69	1. Topics I through III are largely review.
II. Polynomials	Adding and subtracting polynomials. Multiplying polynomials. Factoring polynomials. Dividing polynomials.	UAA Ch. 3, pp. 71-111	
III. Rational Expressions	Laws of Exponents. Multiplying and dividing. Adding and subtracting. Rational expressions in equations. Problems.	UAA Ch. 4, pp. 115-150	
IV. Extending the Number System	Roots. Irrational Numbers. Operations with radicals. Complex numbers. Operations with complex numbers.	UAA Ch. 5, pp. 151-194	1.Complex numbers are not prescribed in Algebra 11.
V. Systems of Linear Sentences	Solving systems. Problems. Graphing systems of linear inequalities.	UAA Ch. 6, pp. 195-222	1.Include linear systems in three variables. (Not in Algebra 11)
VI. Relations and Functions	Specifying relations and functions. Linear functions. Direct variation. Inverse relations. Some graphing techniques: a. horizontal and vertical translations b. dilations c. reflections	UAA Ch. 7, pp. 224-263	1. Include parallel and perpendicular lines.

ALGEBRA 11 (HONORS FORMAT (continued)

COURSE CONTENT TOPIC		PRESCRIBED	REMARKS
VII. Quadratic Sentences	Graphing quadratic functions. Maximum and minimum. Solving quadratic equations. The discriminant. Radical equations. Quadratic inequalities.	UAA Ch. 8, pp. 269-305	1. The discriminant of the quadratic equation is not prescribed in Algebra 11.
VIII. Trigonometry	Angles and their measure. The six trigonometric functions and their graphs. Using a table to find the trigometric values of any angle. Solving right triangles. Solving oblique triangles. Vectors.	UAA Ch. 12, pp. 427-457	1. Students should be encourgaged to use calculators in solving triangles.

ALGEBRA 12 (REGULAR FORMAT)

COURSE CONTENT TOPIC	The student is able to develop an understanding of, and an ability to perform the required operations for each topic:	PRESCRIBED	REMARKS
I. Complex Numbers	Complex numbers. Operating with complex numbers.	UAA Ch. 5, pp. 176-194	1. The real number system & operations with radicals (UAA Ch. 5) should be reviewed.
II. Conics and Quadratic Systems	Distance formula Circles. Parabolas. Ellipses. Hyperbolas. General Conics. Inverse Variation. Quadratic Systems. Problems.	UAA Ch. 9, pp. 307-349	2. Graphing techniques (UAA Ch. 7) should be reviewed before starting this unit.
III. Exponents and Logarithms	Real Exponents. The Exponential Function. The Logarithmic Function. A Table of Commn Logs. The laws of Computation. Logarithmic Equations. Solving Equations using Logarithms. Problems.	UAA Ch. 10, pp. 351-385	
IV. Sequences and Series	Arithmetic sequences and series. Geometric sequences and series. Infinite geometric series. The Binomial Theorem.	UAA Ch. 11, pp. 389-425	
V. Trigonometry	The six trigonometric functions (see remarks) The law of cosines. The law of sines. Solving oblique triangles. Vector trigonometry. The eight basic trigonometry identities. Sum and difference identities. Double and half-angle identities. Conditional trigonometric equations.	1. UAA Ch. 12, pp. 427-457 2. Ch. 13, pp. 458-478	1. The six trigonometric functions are prescribed in Alg. 11, and are repeated here to review and to consolidate the student's understanding of the topic.

ALGEBRA 12 (REGULAR FORMAT) (continued)

COURSE CONTENT TOPIC		PRESCRIBED	REMARKS
V. Trigonometry (continued)			2. Trigonometric functions of angles measured in radians is treated lightly in UAA. The teacher should supplement this work.
VI. Polynomial Equations	Synthetic division. Remainder & factor theorems. Integral Roots. Rational Roots. Fundamental Theorem of Algebra.	UAA Ch. 14 pp. 480-504	

ALGEBRA 12 (HONORS FORMAT)

COURSE CONTENT TOPIC	The student is able to develop an understanding of, and an ability to perform the required operations for each topic:	PRESCRIBED	REMARKS
I. Trigonometry	Areas of triangles. Velocity.	1. UAA Ch. 12, pp. 426-455 2. PCM Ch. 6, pp. 180-185 (sections 6-5 and 6-6)	1. Trigonometry is introduced in Algebra 11 and Algebra 11(H). Students should review this material.
II. Circular Functions	The circular functions and their graphs. Identities. Inverse circular relations and inverse circular functions. Equations involving circular functions. Trigonometric form of complex numbers and De Moivre's Theorem.	1. PCM Ch. 5, pp. 125-164 (sections 5-2 through 5-10) 2. PCM Ch. 6, pp. 186-193 (section 6-7) 3. UAA Ch. 13, pp. 459-478	1. Since UAA does not cover all of the prescribed material, PCM should be used as a basis for this topic. 2. The work on trigonometric equations in PCM should be supplemented by using additional equations from UAA.
III. Vectors in the Plane	Vectors. Addition and scalar multiplication. Vector co-ordinates. The vector system. The norm. Projections and components. Unit vectors. Basic vectors. Dot (scalar) product.	PCM Ch. 7, pp. 197-232 (sections 7-1 through 7-9)	
IV. The Second Degree Relations	Distance formula and mid-point formula. Circle. Parabola. Hyperbola. Ellipse. Inverse variation. Solving quadratic equations. Problems.	1. UAA Ch. 9, pp. 307-349 (sections 9-1 through 9-11) 2. PCM Ch. 9, pp. 273-285 (sections 9-1 through 9-11)	1. Some topics not covered in PCM are covered in UAA and vice versa. 2. Particular emphasis should be given to translation of the curve and/or axes in this topic. 3. Students should be **shown**, using rotation of axes, that every second degree equation represents a conic section. They need not do problems involving rotation.

ALGEBRA 12 (HONORS FORMAT) (continued)

TOPIC	CONTENT	PRESCRIBED	REMARKS
V. Graphing Techniques	Symmetry. Intercepts and excluded regions. Asymptotes. Translations. Continuity.	PCM Ch. 4, pp. 97-112 & pp. 118-121 (sections 4-1 through 4-4 and 4-7)	1. Take prior to topic VI.
VI. Polynomial and Rational Functions	Polynomials. Graphing polynomials. Division algorithm & Remainder theorem. Factor theorem. Fundamental theorem. Locating zeros. Rational zero theorem. Complex zeros. Irrational zeros. Rational functions.	PCM Ch. 10, pp. 297-332 (sections 10-1 through 10-10)	1. Good place to use a calculator.
VII. Transcendental Functions	Exponential function. The number "e". Growth and decay functions. Logarithmic functions. Exponential and logarithmic equations.	1. PCM Ch. 11, pp. 333-357 (sections 11-1 through through 11-5) 2. UAA Ch. 10	1. The approximation of "e" by the binomial theorem should be discussed after IX, 4.
VIII. Polar Co-ordinates	Polar representation. Polar graphs. Equations of lines and circles. Graphing techniques. Classied curves.	PCM Ch. 12, pp. 363-390 (sections 12-2 through 12-5)	1. Treat material in 12(3) lightly, graphs of classical curves should be emphasized.
IX. Sequences and Series	Arithmetic sequences and series. Geometric sequences and series. Infinite geometric series. Binomial theorem.	UAA Ch. 11, pp. 388-425 (sections 11-1 through 11-9)	1. The treatment and content in UAA should form the basis of this topic. Use additional questions from PCM chapter 13.

ALGEBRA 12H (HONORS) — ADDITIONAL TOPICS

The student is able to develop an understanding of, and an ability to perform the required operations for at least one of the following topics:

Students should be expected to study at least one of the following topics in addition to the prescribed core listed above.

These topics are listed in order of priority.

1. Vectors in 3 space — Ch. 8 PCM
   - Scalar and cross products
   - Equations of lines and planes
   - Quadric surfaces — Ch. 9 section 6 PCM

2. Linear algebra
   - Matrices
   - Determinants
   - Solution of linear equations using matrices
   - Operation with matrices-addition, multiplication
   - Inverses
   - Cramer's rule
   - Linear transformations including rotation of axes

3. Introduction to calculus — Ch. 14-16 PCM
   - Limits
   - Derivatives
   - Integrals

   Warning: this is a non-trivial approach and is **not** intuitive calculus.

4. Probability and statistics — Ch. 15 UAA
   - Permutations
   - Combinations
   - Simple probability
   - Introductory statistics

BUSINESS AND CONSUMER MATHEMATICS 11 (Cn Ma 11)

This course is designed for students interested in careers in business or commerce, and for students who wish to become knowledgeable consumers. The course can be adapted to meet the differing needs and interests of each of these groups and the subject matter can be treated in such a way that students need only a minimal level of algebraic skills. In schools where there exists a sufficiently high level of interest and/or demand, the topics listed may be developed in more depth.

The topics should be approached through the solution of real problems in measurement, graphing, interest, discount, profit and loss, installment buying, financing, banking, taxation, annuities, simple statistics, probability, investment, insurance, mortgages, budgetting, etc.

Consultation with teachers of business education and home economics is recommended.

Learning Outcomes

The student is able to develop an understanding of:

1. the basic arithmetical computations (addition, subtraction, multiplication, division of whole numbers, fractions, decimals, percentage) with applications to specific business problems.

2. the Mathematics of Retailing and Accounting
   a) ratio, proportion, percent, markup and markdown
   b) discount, commission, depreciation, inflation
   c) taxes - personal
   - property
   - sales

3. the Mathematics of Banking and Finance
   a) simple interest
   b) compound interest
   c) mortgages
   d) credit cards, installment financing
   e) annuities

4. the Mathematics of Investment
   a) stocks and bonds
   b) insurance - life insurance
   - homeowner's insurance
   - automobile insurance
   c) pension, retirement savings plans, etc.

5. the Mathematics of Decision Making
   a) probability as applied to business
   b) statistics as applied to business

6. consumerism
   a) market surveys
   b) budgeting
   c) laws for consumers

INDUSTRIAL AND TRADE MATHEMATICS 11 (TMa 11)

This course is designed for students interested in careers in trades and industry. The course can be adapted to meet the differing needs and interests of students going into a variety of trades, and the subject matter can be widely varied depending upon the career goals of the students. Practical problems in the mathematics of a wide variety of trades can be included and the particular choice of applications remains a school option.

Consultation with teachers of industrial education is recommended.

Learning Outcomes

The student is able to develop an understanding of:

1. fundamentals of basic arithmetic
   a) operations with whole numbers, fractions
   b) measurement
   c) percentages and averages
   d) finance
   e) graphs

2. fundamentals of algebra with applications
   a) use of symbols
   b) equations
   c) ratio and proportion,
   d) exponents and radicals
   e) use of formulas

3. geometry and trigonometry with applications
   a) concepts of lines, angles, circles
   b) plane and solid figures
   c) basic geometric constructions
   d) trigonometric functions
   e) applications of trigonometry to right and oblique triangles

4. aids in calculation
   a) slide rule
   b) pocket calculator
   c) use of tables

Optional Units for the following trades are available.
a) Plumbers and pipefitters
b) Automotive technicians
c) Carpenters
d) Electricians
e) Machinists
f) Welders

COMPUTING SCIENCE 11 (CSc 11)

This course is designed for any student who is interested in computers and can be adapted to meet the differing needs and interests of the students. The subject matter can be treated in such a way that students need only a minimal level of algebraic skills. The course can be adapted to available equipment whether it be a mini-computer, a remote terminal, or even daily pick-up of cards for processing. In schools where there exists a sufficiently high level of interest and/or demand, the topics listed can be developed in more depth.

It is generally felt that a first course in Computing Science should be more than just a programming course. The course should include programming experience but it should also provide the student with a good general knowledge of how computers have and will affect society. The course should also introduce the student to the many computer related jobs which do not involve programming and outline the educational requirements of employment opportunities involved.

The major goals of the course and/or courses should be to:

1. Develop an appreciation of the role of computers in our society.
2. Obtain basic understanding of the computer as a machine: its capabilities and limitations.
3. Develop the algorithmic process of thought.
4. Acquire a working knowledge of a programming language.
5. Develop skills enabling the student to use the computer for problem solving.

Course Content

Topics	Minimum and maximum number of hours which should be spent on topic.
a) hardware	1-5
b) assembly and machine language	1-1
c) flow charting	2-5
d) documentation	2-5
e) high level language	
i) basic features	20-30
ii) advanced features	5-5
f) applications	
i) mathematical	
ii) data processing	31-39
iii) other	
g) computers and society	5-10
h) employment opportunities	1-2
i) operating systems	1-3
j) exams	3-3

Learning Outcomes (CSc 11)

The student is able to develop an understanding of, and an ability to perform the required operations for each topic:

Part 1: Fundamental Concepts	**hours min. - max.**
1. basic machine structure and specific I/O devices being used	1-3
2. preparing and running sample program	2-3

3.	a) fundamental language features such as constants, variables, assignment statements, simple output, termination.	3-5
	b) simple applications	2-3
4.	fundamental flowchart concepts	1-1
5.	a) program documentation using comments	1-1
	b) simple applications	2-3
		12-19

Part 2: A little more depth. (As each new feature of the language is introduced, its flowchart representation should be introduced and used and at least one program should be written using that feature.)

1.	Unconditional branching	3-4
2.	Conditional branching	4-6
3.	Simple input	3-5
4.	Documentation - title printing	3-4
		13-19

Part 3: A broader view. (Material on computers and society should be covered concurrently, using one or two periods per week, with the programming topics.)

1.	Library functions	4-6
2.	Loop control (DO, FOR, NEXT, etc.)	6-8
3.	Singly subscripted variables	9-15
4.	Computers and Society	5-10
		24-39

Part 4: Projects and Advanced features. (Employment opportunities done in same way as Computers and Society.)

1.	Assembly and machine language (an overview only)	1-1
2.	Operating system (an overview only)	1-2
3.	Advanced language features	5-5
4.	Writing Programs (Individual student projects)	10-12
5.	Employment opportunities	1-2
6.	Hardware	0-2
		18-24

SENIOR GEOMETRY 12 (GEOM 12)

The development of geometric concepts begins at an early age and the revised curriculum grades 1-10 recognizes this by emphasizing an intuitive approach. Secondary school geometry has traditionally been viewed as the study of a single axiomatic system, with topics added at an appropriate level from analytic geometry and vectors. Such a development may place severe restraints on students and frequently is hard to motivate.

This course extends the ideas developed in Grades 1-10 and is a blend of topics chosen from Euclidean, coordinate, vector and transformational geometries. Manipulative experiences and applied problems should be emphasized so that the course can be adapted to students of varying ability. Some of the concepts in the suggested outline are difficult and should be introduced only to students of above average ability. Although teachers can select topics which emphasize a particular approach to geometry, the use of a variety of approaches will greatly enrich the subject.

Learning Outcomes

The student is able to develop an understanding of, and an ability to perform the required operations for each topic:

1. Geometry of the real world — two and three dimensions.
2. Angles and their measure.
3. Coordinate geometry — Cartesian coordinates, polar coordinates. Simple loci - circle, straight line.
4. The properties of rectangular figures and solids — a deductive approach.
5. The properties of special triangles — right, equilateral, isosceles.
6. Reflections, rotations and translations — the geometry of motion.
7. Similarity, congruence — properties of circles, regular polygons. Similarity transformations.
8. Deduction and proof. Elementary logic.
9. Areas and volumes of regular figures and solids.
10. Vector geometry — addition, subtraction, algebra of vectors.
11. Composite transformations or mappings. Congruence transformations.

PROBABILITY AND STATISTICS 12 (PS 12)

This course is designed for students interested in the application of mathematics to areas such as probability and statistics. Topics may be chosen from the list below to meet the needs, abilities and interests of various groups of students. For example, teachers might emphasize applications to biology, business, social sciences.

Learning Outcomes

The student is able to develop an understanding of, and an ability to perform the required operations for each topic.

1. Algebra of sets
   - $A \cup B$; $A \cap B$; A'
   - distributive law for sets
   - n(A) — number of elements in a set
   - tree diagrams.

2. Permutations and combinations
   - factorial notation
   - binomial theorem
   - counting problems — combinations, permutations.

3. Elemenatary probability
   - sample spaces
   - simple examples
   - conditional probability
   - independent events, mutually exclusive events
   - repeated trials (Bernoulli trials)
   - games of chance
   - expected value.
   - mathematical and experimental probability.

4. Statistics (a descriptive approach)
   - representation of data by various types of graphs mean, median, mode — calculation and use — grouped and ungrouped data
   - standard deviation
   - "grading on the curve"
   - sampling theory
   - random samples
   - variance of samples
   - small samples
   - large samples
   - correlation
   - testing hypotheses.

5. Optional topics
   a) Logic
      - $a \wedge b$; $a \vee b$; $a \rightarrow b$; $\sim a$
      - truth tables
      - converse, contrapositive
      - algebra of statements
      - arguments
   b) Review of exponential and logarithmic functions and graphs.
   c) Binomial and normal distributions.

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APPENDIX

(1) Prescribed Textbook List

The textbooks authorized for the various levels of the mathematics program are listed below. Teachers' editions are indicated where applicable. A **Prescribed Textbook List** is published annually by the Curriculum Development Branch and is available from the Publication Services Branch. The scale of issue of authorized texts is indicated in the Prescribed Textbook List.

Primary Grades — I, II, III

Mathematics	I	1. a) Eicholtz, O'Daffer: Investigating School Mathematics (Addison-Wesley) b) Elliott et al.: Project Mathematics (Holt, Rinehart and Winston) c) Dilley et al.: Heath Elementary Mathematics (D.C. Heath) 2. Eicholtz, O'Daffer: Investigating School Mathematics, Teachers' Edition (Addison-Wesley) 3. Elliott et al.: Project Mathematics, Teachers' Edition (Holt, Rinehart and Winston) 4. Dilley et al.: Heath Elementary Mathematics, Teachers' Edition (D.C. Heath) 5. Huff, Irwin: Activities in Geometry (Addison-Wesley)
	II	1. a) Eicholtz, O'Daffer: Investigating School Mathematics (Addison-Wesley) b) Elliott et al.: Project Mathematics (Holt, Rinehart and Winston) c) Dilley et al.: Heath Elementary Mathematics (D.C. Heath) 2. Eicholtz, O'Daffer: Investigating School Mathematics, Teachers' Edition (Addison-Wesley) 3. Elliott et al.: Project Mathematics, Teachers' Edition (Holt, Rinehart and Winston) 4. Dilley et al.: Heath Elementary Mathematics, Teachers' Edition (D.C. Heath) 5. Huff, Irwin: Activities in Geometry (Addison-Wesley)
	III	1. a) Eicholtz, O'Daffer: Investigating School Mathematics (Addison-Wesley) b) Elliott et al.: Project Mathematics (Holt, Rinehart and Winston) c) Dilley et al.: Heath Elementary Mathematics (D.C. Heath) 2. Huff, Irwin: Activities in Geometry (Addison-Wesley)

Intermediate Grades — IV, V, VI, VII

Mathematics	IV	a) Dilley et al.: Heath Elementary Mathematics — 4 (D.C. Heath)[1] b) Eicholtz et al.: Investigating School Mathematics — 4 (Addison-Wesley)[1]

		c) Elliott et al.: Project Mathematics — 4 (Holt, Rinehart and Winston)[1]
	V	a) Dilley et al.: Heath Elementary Mathematics — 5 (D.C. Heath)[1] b) Eicholtz et al.: Investigating School Mathematics — 5 (Addison-Wesley)[1] c) Elliott et al.: Project Mathematics — 5 (Holt, Rinehart and Winston)[1]
	VI	a) Dilley et al.: Heath Elementary Mathematics — 6 (D.C. Heath)[1] b) Eicholtz et al.: Investigating School Mathematics — 6 (Addison-Wesley)[1] c) Elliott et al.: Project Mathematics — 6 (Holt, Rinehart and Winston)[1]
	VII	a) Eicholtz, et al.: School Mathematics I, Metric Edition (Addison-Wesley)[1] b) Sobel, Maletsky: Mathematics I, Metric Edition (Ginn)[1] c) Sobel, Maletsky: Essentials of Mathematics, Metric Edition (Ginn)[1]
		Secondary Grades — VII TO XII
Mathematics	VIII	a) Eicholtz et al.: School Mathematics II (Addison-Wesley)[1] b) Sobel, Maletsky: Mathematics II (Ginn) c) Sobel, Maletsky: Essential of Mathematics II (Ginn)
	IX, X	a) Newton et al.: Mathematics for a Modern World, Book 1 (Gage) b) Newton et al.: Mathematics for a Modern World, Book 2 (Gage) c) Sobel, Maletsky: Essentials of Mathematics 3 (Ginn) d) Dolciani: Modern Algebra, Book 1 — Modules 1, 2, 3 (Houghton-Mifflin) — Ma 9 e) Dolciani, Modern Algebra, Book 1 — Modules 4, 5, 6 (Houghton-Mifflin) — Ma 10 f) Wigle et al.: Mathematical Pursuits One (Macmillan) g) Bernstein, Wells: Trouble-shooting Mathematics Skills (Holt, Rinehart and Winston) h) Wigle et al.: Mathematical Pursuits Two (Macmillan) i) Conchie: Business and Consumer Mathematics (Addison-Wesley) j) Lyng et al.: Career Mathematics, Industry and Trade (Houghton-Mifflin)
*Mathematics 11	XI	Dolciani: Modern Algebra and Trigonometry, Book 2 (Nelson)
*General Mathematics 11	XI	Weib: Foundation of Mathematics (Holt, Rinehart and Winston)[1]

* Note: These courses will be discontinued in September, 1977.

[1] Teachers' Manual available by purchase from the Publication Services Branch.

Algebra 11	XI	a) Del Grande et al.: Mathematics For a Modern World 1112 (Gage) b) Travers: Using Advanced Algeora (Doubleday)
Consumer Mathematics 11	XI	1. Bello: Contemporary Business Mathematics — Canadian Metric Edition (W.B. Saunders)

		2. Conchie: Business and Consumer Mathematics (Addison-Wesley)
Computing Science 11	XI	See note page 4 of this Guide.
Trades Mathematics 11	XI	1. Olivio: Basic Mathematics Simplified — Canadian Metric Edition (Van Nostrand Reinhold) 2. (Any or all of the 6 Modules in the following series may be selected providing the total number of modules ordered does not exceed one A issue): — Practical Problems in Mathematics Series (Van Nostrand Reinhold) (Modules: Welders; Auto Technicians; Carpenters; Electricians; Machinists; Plumbers and Pipefitters). — Instructor's Guides for the Modules listed may be purchased from the Publication Services Branch.
Mathematics 12	XII*	1. Dolciani: Modern Algebra and Trigonometry, Book 2 (Nelson) 2. Jennings: Introduction to Calculus (Department of Education)

Note: These courses will be discontinued in September, 1978.

Algebra 12	XII	a) Del Grande et al.: Mathematics For a Modern World 1112 (Gage) b) Travers: Using Advanced Algebra (Doubleday) c) Crosswhite et al.: Pre Calculus Mathematics (Merrill)
Geometry 12	XII	Graening and Nibbelink: Geometry (Merrill)
Probability and Statistics 12	XII	Willoughby: Probability and Statistics (GLC Canada)

APPENDIX

(2) Materials and Equipment **Years 1-8**

In the current program manipulative materials have assumed much greater emphasis than in the past. It is hoped that all students will experience the satisfaction of discovering mathematical relationships through manipulating concrete objects. The following have been identified as suitable aids in providing manipulative experiences.

A. Non-Metric

1. Multi-base Loop Abacus
2. Canadian Play Money
3. Plastic Counters
4. Cuisinaire rods
5. Geometric solids and dissectible cones, spheres
6. Geometric plane shapes (metric dimensions preferred)
7. Geoboards
8. Mathematical balance
9. Tangram playfits and Tangram Puzzles Book
10. Fraction playfits
11. Coffee Stir Sticks
12. Shotgun wads
13. Stop watch
14. Mirror Cards (Elementary Science Study) (McGraw-Hill)
15. Fraction Dominoes
16. Pattern Blocks and Mirrors (Setsco)
17. Geocards — Geoboard Activity Cards (Houghton Mifflin)
18. Project Math Activity Kit (Holt, Rinehart & Winston)
19. Sydney Cylinder Primary Math Lab (Scholar's Choice,
    50 Ballantyne Ave.,
    Stratford, Ontario)
20. Orbit Material for Mathematics (Book Society of Canada,
    Box 200,
    Agincourt, Ontario)
21. Individualized Math Lab (Random House/Singer,
    c/o Peter Clark,
    15772 Goggs Avenue,
    White Rock, B.C.)
22. Teaching Aids For Modern Mathematics (Holt, Rinehart & Winston)
23. Math Skills Kit (Van Nostrand Reinhold)

B. Metric Measurement Equipment

1. Blackboard metre stick
2. Metre stick (cm and mm)
3. Metric tapes
   150 cm (cm and mm)
   10 m (fibre glass)
   30 m (fibre glass)
   50 m (fibre glass)
4. Metric trundle wheel
5. Micrometre
6. Large Vernier Caliper
7. SI 30 cm rule (cm and m)
8. Primary 30 cm rule (cm only)
9. Metric graph paper (pkg/200)
10. Centimetre Base Ten Set
11. Centicubes (pkg/1000)
12. Centicube Teacher's Guide
13. Metric bathroom scale — 125 kg
14. Elementary School Balance (OHAUS or equal)
15. Bucket and Pan Balance
16. Beam Balance
17. Metric Pan Balance — 2 kg
18. Sets of Standard masses
    i) Stacking Plastic Mass Set (5 × 20 g, 10 × 10 g, 20 × 5 g)
    ii) Cast iron Mass Set (1 kg largest mass)
    iii) Primary masses (plastic) (10 × 10 g, 10 × 5 g)
19. Spring Balances (250 g, 500 g, 2000 g, 3 kg, 6 kg, 10 kg)
20. Litre measuring jug
21. Polyethylene Pails (graduated internally in litres)
22. Graduated Beaker Set (10 ml to 1000 ml)
23. Graduated Cylinders (clear plastic) 25 ml to 500 ml
24. Open cube (10 cm × cm) (clear or translucent plastic)
25. Demonstration thermometer (large) −5°C to +30°C
26. Metal-Backed thermometer −30°C to +110°C
27. Wall thermometer −30°C to +50°C
28. Dipping thermometer −10°C to +110°C
29. Clinical Thermometer
30. Pin boards (geoboards) (square lattice) 6 × 6 at 2 cm spacing — clear; 11 × 11 at 2 cm spacing — plastic
31. Circular pin board — 1 cm grid — clear plastic (24 pins)

APPENDIX

(3) Supplementary and Reference Materials **Years 1 - 8**

THE ARITHMETIC TEACHER: THE MATHEMATICS TEACHER
Subscription price includes membership in the Council.

Very worthwhile journals published monthly 8 times a year, October through May, by the National Council of Teachers of Mathematics.

NOTES ON MATHEMATICS IN PRIMARY SCHOOLS
Members of the Association of Teachers of Mathematics.
(Cambridge University Press)
Full of excellent ideas. (Grades K-6)

MATHEMATICS IN PRIMARY SCHOOLS
Curriculum Bulletin No. 1, The Schools Council
(Write SEE for latest catalogue or order from Her Majesty's Stationery Office).

The scope of this English bulletin is wide, as it aims not only at presenting the philosophy of the changes to which reference is made, but also at providing material help for teachers in their own classrooms, and particularly for teachers with large classes in small classrooms. It contains a great deal of helpful material for our elementary teachers. One of the most valuable books available. (K-6)

FREEDOM TO LEARN — AN ACTIVE LEARNING APPROACH TO MATHEMATICS
E.E. Biggs and J.R. MacLean (Addison-Wesley Canada Ltd.)

I DO AND I UNDERSTAND
(John Wiley & Sons)

PICTORIAL REPRESENTATIONS
(John Wiley & Sons)

Two excellent Nuffield Foundation Mathematics Project publications. The former is a guide for teachers and deals with the practical problems of classroom management encountered when children are set free in the classroom to make their own discoveries with concrete materials. The latter is designed to help teachers develop the pupil's ability to use graphs of various kinds. (K-6)

A number of other publications are available from the same source.

WORKJOBS
Mary Baratta Lorton (Addison-Wesley Canada Ltd.)

TEACHING AIDS FOR MODERN MATHEMATICS
Paper. (Holt, Rinehart & Winston)

A source book of ideas for elementary school teachers. Contains items that are inexpensive and easy to make, with directions for their construction and use and suggestions for possible variations. (K-6)

Supportive materials are available for all prescribed math texts. Consult the catalogues for supportive materials — transparencies, duplicator masters, test, workbooks, etc.

INDIVIDUALIZING MATHEMATICS
(Addison-Wesley) 1970
Skills and Patterns
Patterns and Discovery
Discovery and Structure

ARITHMETIC: A MODERN APPROACH
Keedy, Bittinger
(Addison-Wesley) 1971

ACTIVITIES IN MATHEMATICS
Course I and II
Johnson, et al. (Scott Foresman) 1973

GEOBOARD GEOMETRY
(Farrell, Creative Publications) 1971

Distributed by: (Setsco Educational Ltd.,
1315 West 71 Avenue, Vancouver, B.C.

GEOBOARD ACTIVITY SHEETS
Cech, Tate
(Ideal School Supply Co.) 1970

AFTERMATH SERIES, BOOKS 1-4
Seymour, et al.
(Creative Publications) 1970
Distributed by: Setsco Educational Ltd.

MATHSENSE
Ailles
(Ginn) 1973

WE'RE GOING METRIC
D'Arcy, Knox,
(Heinemann Educational Books, London) 1971

METRICATION — A GUIDE FOR CONSUMERS
Consumer Research Report #2
Department of Consumer and Corporate Affairs,
Ottawa, 1972

METRIC MEASUREMENT
Cortese, Herer
(American Book Co.) 1970

THINK METRIC!
Branley
(T.Y. Crowell Co.) 1972

MATHEMATICS WITH METRIC MEASURE
GLC(General Learning Corporation)

MATH SKILLS KIT II a, b, c, d
McCormick - Mathers Publication Company

SYDNEY CYLINDERS MATHLAB METRIC
Scholar's Choice Ltd.

PEDAGOGICAL IMPLICATIONS OF METRICATION
(Council of Ministers of Education — expected Fall of 1976)

HOW TO GO METRIC AND LIKE IT
Gage (for parents)

METRIC STYLE GUIDE
Council of Ministers of Education of Canada

ELEMENTARY SCHOOL MATHEMATICS
Activities and Materials — George F. Green Jr.
(D.C. Heath & Co.)

MATHEMATICAL UNITS — INTRODUCING STATISTICS
E.E. Shuker
(Evans Bros. Ltd., London) 1970

TANGLETABLE MATH
(Creative Publications)
Distributed by: Setsco Educational Ltd.

TANGRAMATH
(Creative Publications)
Distributed by: Setsco Educational Ltd.

MATHIMAGINATION
(Creative Publications)
Distributed by: Setsco Educational Ltd.

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MATHEMETRICS BOOKS 1-5
(Book Society of Canada Ltd.)

HOLT . MATHS BOOKS 1-5
Holt, Michael
(Macmillan Company of Canada)

MATHWAYS YEARS 1-6
Bates, et al
(Copp Clark)

FIRST STEP IN GEOMETRY
G.R. Gibson
(Evans Brothers Limited, London)

GAMES FOR INDIVIDUALIZING MATHEMATICS LEARNING
L. Kennedy & R. Michon
(Charles Merrill Pub. Co.)

MATHACTION BOOKS 1-8
W.W. Bates et al
(Copp Clark Publishing Co. 1970)

USING AND UNDERSTANDING THE METRIC SYSTEM
69000 (SI Metric)
(McIntyre Educational Media Ltd.)

METRIC MAGIC
6497 7M (SI Metric)
(McIntyre Educational Media Ltd.)

ADDITION AND SUBTRACTION WITH A HAPPY ENDING
Marcy & Marcy
(Creative Publications)

ACTIVITIES WITH GEOBLOCKS
Seymour
(Creative Publications)

CROSSNUMBER PUZZLE BOOK I
Hestwood, et al
(Creative Publications)

NUMBER BLOX ACTIVITIES BOOK A AND B
Neufeld & Lucas
(Creative Publications)

PATTERN BLOCKS ACTIVITIES BOOK A AND B
Pasternack & Silvey
(Creative Publications)

PATTERN BLOCKS COLORING BOOK
Pasternack & Silvey
(Creative Publications)

FRACTIONS WITH PATTERN BLOCKS
Zullie
(Creative Publications)

The above Creative Publications Materials are distributed by:
Setsco Educational Ltd.
1315 West 71st Avenue
Vancouver, B.C.

FLIGHT INTO METRICS
(SI metric package)
Primary - 6
(Scholar's Choice)

bjs MATHGAMES
(SI metric)
Primary - 6
232-827 Addition and Subtraction
232-835 Multiplication and Division
232-843 Geometry

Scholar's Choice Limited
50 Ballantyne Ave.
Stratford, Ontario N5A 6T9

SRA MATHEMATICS LEARNING SYSTEM YEARS 1 - 6
(SI Metric)
Science Research Associates Ltd.
707 Gordon Road
Willowdale, Ontario M2H 2S6

GENERAL MATH I
Shaw, Wheatley, Kane, Schaefer
(Houghton-Mifflin Canada Ltd.) 1977

APPENDIX

Years 9-10

ADVENTURES WITH ARITHMETIC
Swienciki, Lawrence N.

Book 1. Fractions
Book 2. Decimals
Book 3. Percent
Book 4. Algebra

Distributed by (Setsco Educational Ltd.)
1315 West 71 Avenue, Vancouver, B.C.

ALGEBRA I
Dolciani, Wooton, Beckenbach
1974 (Houghton, Mifflin Co.)

ALGEBRA I (teachers edition)
Vogeli, Prevost, Gilbert, Carroll
1971 (Silver Burdett Co. — General Learning Corporation)

- Flow charts and computers are included in each chapter to provide opportunities to integrate computer instruction with instruction in algebra.

ALGEBRA: A MODERN INTRODUCTION (instructor's manual)
Keedy, Bittinger
1973 (Addison-Wesley Publishing Co. Inc.)

- The instructors manual suggests that the series of 12 booklets is intended for a course in elementary algebra over two years. Tests pertaining to the series include: Booklet tests; Pretests; Achievement Tests; Cumulative Tests.

Booklet 1: Whole Numbers; Addition and Subtraction

Booklet 2: Whole Numbers; Multiplication and Division

Booklet 3: Operations of the numbers of Arithmetic

Booklet 4: Decimals and Percent

Booklet 5: Measures, Ratio and Averages

Booklet 6: The numbers of ordinary Arithmetic and Algebra

Booklet 7: Rational numbers; Algebra and Solving Equations

Booklet 8: Polynomials

Booklet 9: Functions and Basic Geometry

Booklet 10: Linear Equations and Systems of Equations

Booklet 11: Polynomials in Several Variables and Fractional Equations.

Booklet 12: Roots, Radicals, and Quadratic Equations

ALGEBRA: THE LANGUAGE OF MATHEMATICS (Teachers Edition)
Johnson and Johnson
1975 (Addison-Wesley)

APPLICATIONS IN MATHEMATICS: COURSE B
Johnson, Hansen, Peterson, Rudnick, Cleveland, Bolster
1974 (Scott, Foreman and Company)
-student activities in the lessons.
-duplicating masters available for each unit.

APPLIED MATHEMATICS TODAY: AN INTRODUCTION
D. Dottori, G. Knill, R. McVean, J. Seymour
1974 (McGraw-Hill-Ryerson)

BUSINESS AND CONSUMER MATHEMATICS
Saake, T.F.
(Duplicating masters available from Addison-Wesley)

CANADA GOES METRIC
G.J. Black
(Doubleday Canada Ltd.)

CONSUMER MATHEMATICS
Francis G. Lankford, Jr. and William E. Goe
1971 (Harcourt Brace Dovanovich Inc.)

-Content is related to typical everyday consumer problems.

CONSUMER RELATED MATHEMATICS (Teachers Edition) SI Metric Ed.
Kravitz, Brant
1976 (Holt, Rinehart and Winston Inc.)

-Emphasizes computational skills, problems from the world of business and industry.

ELEMENTARY ALGEBRA Part 1
Denholm, Dolciani, Cunningham
1970 (Houghton Mifflin Co.)

ELEMENTARY ALGEBRA Part 2
Denholm, Dolciani
1971 (Houghton Mifflin Co.)

ESSENTIALS OF MATHEMATICS: SKILLS AND CONCEPTS Book 4
Sobel, Maletsky
1973 (Ginn and Company)

FUNDAMENTALS OF MATHEMATICS
Stein
1971 Canadian Edition, (The Macmillan Company of Canada)
-Generally satisfies the objectives in the Mathematics Curriculum Guide.
-Includes exercises on review of computational skills

GEOMETRY IN MODULES 4 copies: a, b, c, d.
Muriel Lange
1975 (Addison-Wesley)

HOLT ALGEBRA I
Nichols, Edwards, Garland Hoffman, Mamary, Palmer
1974 (Holt, Rinehart and Winston Inc.)

-A good source for exercises

LET'S GO METRIC
Donovan
1974 (Waybright and Talley)

MATH PROBE, 2 and 3
Bye, Elliot
1973 (Holt, Rinehart and Winston of Canada)

-Discovery exercises may be done in groups.

MATH PROBE 4
Krysah, Bye, Elliot
1973 (Holt, Rinehart and Winston of Canada)

MATHEMATICAL PURSUITS ONE AND TWO, Teacher's Guides
Wygle et al
(Macmillan)

MATHEMATICS FOR TODAY AND TOMORROW: METRIC EDITION
Dottori, Knill, McVean, Seymour
1974 (McGraw-Hill-Ryerson)

-Generally satisfies the objectives in the Mathematics Curriculum Guide.

MATHIMAGINATION
Steve and Janice March
(Distributed by Setsco Educational Ltd.)

- Workbooks designed to provide practice in basic mathematics skills.
- Available in Teacher Edition for thermal reproduction

Book A: Beginning Multiplication

Book B: Operations With Whole Numbers

Book C: Number Theory, Sets, Number Bases

Book D: Fractions

Book E: Decimals and Percent

Book F: Geometry, Measurement, Cartesian Coordinates

MODERN ALGEBRA STRUCTURE AND METHOD, BOOK 1
Modules format, Dolciani et al, Set of Tests, Duplicating Masters, Program Practice, Teacher's Guide (Houghton-Mifflin)

MODERN BASIC GEOMETRY
Jurgenson, Maier, Donnelly
1973 (Houghton, Mifflin Co.)

- Algebraic exercises are included in the textbook on geometry.

PREPARING TO USE ALGEBRA
Shulte, Peterson
1975 (Laidlaw Publishing Co., Doubleday Canada Ltd.)

SUCCESS WITH MATHEMATICS (Teacher Edition and Student Edition)
Eicholz, Fleemor, O'Daffer, Ellis, Bittinger
1974 (Addison-Wesley Publishing Co.)

- The book provides opportunity to investigate mathematical ideas. The activity-oriented experiences may appeal to individual needs and interests.

TANGRAMATH
Dale Seymour
(Distributed by Setsco Educational Ltd.)

THE MATHEMATICS OF CONSUMER STUDIES
Canadian Edition, Teachers Edition

TROUBLE SHOOTING MATHEMATICS SKILLS, (Teacher's Edition)
Bernstein and Wells
(Holt, Rinehart and Winston)

- Magic Multiplier Materials Kit including duplicating masters.

LABORATORY EXPERIMENTS FOR ESSENTIALS OF MATHEMATICS 3
Sobel/Maletsky
(Ginn)

GRAPH GALLERY
Boyle
(Creative Publications)

MATHEMATICS CONTEST PROBLEMS
Brousseau
(Creative Publications)

CROSSNUMBER PUZZLE BOOK II
Hestwood, et al
(Creative Publications)

PALATABLE PLOTTING
Boyle
(Creative Publications)

The above Creative Publications materials are distributed by:

Setsco Educational Ltd.
1315 West 71st Avenue
Vancouver, B.C.

BASIC ALGEBRA
Brown, Smith, Dolciani
(Houghton-Mifflin Canada Ltd.) 1977

FILMSTRIP-CASSETTE KIT
i) Operations with Approximate Numbers
ii) Graphing an Equation
(McIntyre Educational Media)

AUDIO-INTERACTIVE CASSETTE KIT
i) Multiplying Factors
ii) Factoring Numbers
iii) Bases and Exponents
(McIntyre Educational Media)

AUDIO-INTERACTIVE CASSETTE KIT
i) Point Coordinates: Quadrant I
ii) Four Quadrants
iii) Graphing an Equation
(McIntyre Educational Media Ltd.)
86 St. Regis Crescent N.
Downsview, Ontario M3J 1Z3

APPENDIX

Years 11-12

Algebra 11 and 12; Algebra 11 and 12 (Honors)

Dolciani et al
ALGEBRA 2 AND TRIGONOMETRY, 2-14176, (Houghton-Mifflin)

Nibbelink/Graening
ALGEBRA 2 WITH TRIGONOMETRY, (Merrill)

Smart, Holmes, Hood
ALGEBRA 2 WITH TRIGONOMETRY, (Ginn)

Moore
PRE-CALCULUS MATHEMATICS, (Wiley)

Sorgenfrey, Wooton, Dolciani
MODERN ALGEBRA AND TRIGONOMETRY, Book 2, (Houghton-Mifflin)

Brown/Robbins
ADVANCED MATHEMATICS AN INTRODUCTORY COURSE, (Houghton-Mifflin)

Devlin et al
INTERMEDIATE ALGEBRA WITH TRIGONOMETRY, (Scott, Foresman)

Shanks, et al
PRE-CALCULUS MATHEMATICS, 2nd edition, (Addison Wesley)

Thomas
ELEMENTS OF CALCULUS AND ANALYCTIC GEOMETRY, (Addison-Wesley)

Vance
MODERN ALGEBRA AND TRIGONOMETRY, 2nd edition, (Addison-Wesley)

Vance
MODERN ALGEBRA AND TRIGONOMETRY, 3rd edition, (Addison-Wesley)

Nichols, et al
HOLT ALGEBRA 2 WITH TRIGONOMETRY, (Holt, Rinehart and Winston)

Vogeli, et al
ALGEBRA 2 AND TRIG, (Silver, Burdett)

Serge Lang
BASIC MATHEMATICS, (Addison-Wesley)

Johnson, Lindsey, et al
FUNDAMENTALS OF COLLEGE ALGEBRA, (Cummings)

Daniel M. Durbin
ELEMENTS OF PRE-CALCULUS MATHEMATICS, (Addison-Wesley)

Raoul L. Weinstein
PRE-CALCULUS MATHEMATICS: A FUNDAMENTAL APPROACH (Addison-Wesley)

Wooton, et al
MODERN TRIGONOMETRY, (Houghton-Mifflin)

Sorgenfrey, Wooton, Dolciani
MODERN ALGEBRA AND TRIGONOMETRY STRUCTURE AND METHOD, New edition, (Houghton-Mifflin)

Wooton, et al
MODERN TRIGONOMETRY, Revised edition, (Houghton-Mifflin)

Dolciani, et al
MODERN INTRODUCTORY ANALYSIS, (Houghton-Mifflin)

Jacobs
MATHEMATICS: A HUMAN ENDEAVOR, (Freeman, San Francisco)

Keedy and Bittinger
ALGEBRA AND TRIGONOMETRY: A FUNCTIONS APPROACH, (Addison-Wesley)

Keedy and Bittinger
INTERMEDIATE ALGEBRA: A MODERN APPROACH, (Addison-Wesley)

Benice, D.D.
PRE-CALCULUS ALGEBRA AND TRIGONOMETRY, (Prentice-Hall)

CONSUMER MATHEMATICS 11

Bello
CONTEMPORARY BUSINESS MATHEMATICS, (W.B. Saunders)
a) Bello, et al
Instructors Manual for above
b) Workbook for above

Conchie
BUSINESS AND CONSUMER MATHEMATICS, (Addison-Wesley)
(Now part of Mathematics 10 program)

Printel and Diamond
BASIC BUSINESS MATHEMATICS, (Prentice-Hall)

Hummel and Seeback
MATHEMATICS OF FINANCE, 3rd edition, (McGraw-Hill)

Skeen, Wheeler, Johnson
MATHEMATICS WITH BUSINESS APPLICATIONS, (Addison-Wesley)

Ayres
MATHEMATICS OF FINANCE, (Schaum Publishing Co.)

Kravitz, Brant
CONSUMER RELATED MATHEMATICS — SI Metric Edition, 1975, (Holt, Rinehart, Winston)

Stelson
MATHEMATICS OF FINANCE, (Van Nostrand Reinhold)

Rosenburg, Sexton
BUSINESS MATH ON THE JOB, (A Practice Set), (McGraw-Hill)

Locke
CONSUMER MATH: A GUIDE TO STRETCHING YOUR DOLLAR, (Self Teaching), (Wiley and Sons)

Daw and Beatty
YOU, THE CONSUMER, 1974, (Wiley and Sons)

"Consumer Education Kit for Teachers"
B.C. Dept. of Consumer Services
838 Fort Street, Victoria, B.C. V8W 1H8

"Teaching Taxes Kit" (Available free annually)
Information Services Branch
Revenue Canada, Taxation
875 Heron Road, Ottawa, Ontario K1A 0L8

TRADES MATHEMATICS 11

Allyn J. Washington
BASIC TECHNICAL MATHEMATICS, (Cummings)

Allyn J. Washington
MODULES IN TECHNICAL MATHEMATICS, (Cummings)

1) Introductory Topics from Arithmetic
2) Introduction to Algebra
3) Introduction to Trigonometry

Dottori
TECHNICAL MATH EXERCISES, 1974, (McGraw-Hill Ryerson Ltd.)

a) Martin Clifford
Electrical Mathematics at Work
b) William W. Rogers and Paul L. Welton
Blueprint Reading at Work: Manufacturing
c) Paul L. Welton and William W. Rogers
Shop Mathematics at Work, 3rd edition
d) Martin Clifford
Drafting Mathematics
a-d) Available from General Learning Corporation
115 Nugget Avenue
Agincourt, Ontario
M1S 3B1

COMPUTING SCIENCE 11

BASIC

Coan
BASIC, BASIC, (Hayden)

Peluso, et al
BASIC, BASIC: SELF-INSTRUCTIONAL MANUAL AND TEXT, (Hayden)

Dwyer and Kaufman
A GUIDED TOUR OF COMPUTER PROGRAMMING IN BASIC, (Houghton-Mifflin)

Z.P. Jacobs, et al
COMMUNICATING WITH THE COMPUTER, INTRODUCTORY EXPERIENCES, BASIC, 1975, (Allyn and Bacon)

Golden
COMPUTER PROGRAMMING IN THE BASIC LANGUAGE, 1975, (Harcourt, Brace, Jovanovich)

J. Petrak and J. Schellenberg
COMPUTER SCIENCE MODULES 1, 2, 3, 4, 1976, (Rand McNally)

Smith
DISCOVERING BASIC, (Hayden)

Smith
A VISUAL APPROACH TO BASIC, (CDC)

DeRossi
LEARNING BASIC FAST, 1975, (Reston)

S.L. Marateck
BASIC, 1975, (Academic Press)

FORTRAN

T. Walker
FUNDAMENTALS OF FORTRAN PROGRAMMING, 1975, (Allyn and Bacon)

Cress, Dirksen and Graham
FORTRAN IV WITH WATFOR AND WATFOR IV, 1970, (Prentice-Hall)

Healy and DeBrauzzi
BASIC FORTRAN IV PROGRAMMING, SELF-INSTRUCTIONAL MANUAL AND TEXT, 1968, (Addison-Wesley)

Z.P. Jacobs, et al
COMMUNICATING WITH THE COMPUTER, INTRODUCTORY EXPERIENCES FORTRAN IV, 1973, (Allyn and Bacon)

PL/L

M. Davidson
PL/1 PROGRAMMING WITH PL/L, 1973, (Houghton-Mifflin)

Bates and Douglas
PROGRAMMING PL/1, 1970 (Automatic Computation Services)

COMPUTERS AND SOCIETY

R.M. Baer
THE DIGITAL VILLAIN, 1972, (Addison-Wesley)

S. Rothman and C. Mosmann
COMPUTERS AND SOCIETY, 1972, (S.R.A.)

D.H. Sanders
COMPUTERS IN SOCIETY, 1973, (McGraw-Hill)

GEOMETRY 12

Nibbelink and Graening
GEOMETRY, (Merrill)

Coxford, Usiskin
GEOMETRY, A TRANSFORMATIONAL APPROACH, (Laidlaw)

Jurgensen, Maier, Donnelly
MODERN BASIC GEOMETRY, (Houghton-Mifflin)

Pearson and Smart
GEOMETRY, (Ginn)

Jacobs
GEOMETRY, (Freeman)
- A teachers guide to Geometry

Ladd, Kelly
ELEMENTS OF GEOMETRY, (Scott-Foresman)

Irving Adler
A NEW LOOK AT GEOMETRY, (Signet Science Library Y3225)
- comes in pocket book form

C.R. Wylie, Jr.
FOUNDATIONS OF GEOMETRY, (McGraw-Hill)

Moise and Downs
GEOMETRY, (Addison-Wesley)

Gordon Fuller
ANALYTIC GEOMETRY, 4th edition, (Addison-Wesley)

Eugene F. Krause
TAXI CAB GEOMETRY, (Addison-Wesley)

Jurgensen, Donnelly, et al
GEOMETRY, 1975, (Houghton-Mifflin)

Jurgensen, Donnelly, Dolliam
MODERN SCHOOL MATHEMATICS GEOMETRY, (Houghton-Mifflin)
- also modules

Anderson, Garon, Gremillion
SCHOOL MATHEMATICS GEOMETRY, (Houghton-Mifflin)

MODERN COORDINATE GEOMETRY, (A Wesleyen Experimental Curriculum Study)

Wooton, Backenbach, Fleming
A MODERN ANALYTIC GEOMETRY, (Houghton-Mifflin)

PROBABILITY AND STATISTICS 12

Blakeslee, Chinn
INTRODUCTORY STATISTICS AND PROBABILITY, (Houghton-Mifflin)

Goodman and Ratti
FINITE MATHEMATICS WITH APPLICATIONS, (Macmillan)

Benice
FINITE MATHEMATICS WITH ALGEBRA, (Saunders)
- Instructors Manual

Mizrahi/Sullivan
FINITE MATHEMATICS WITH APPLICATIONS, (Wiley)

Mosteller, et al
EXPLORING DATA, STATISTICS BY EXAMPLE, (Addison-Wesley)
WEIGHING CHANCES
DETECTING PATTERNS
FINDING MODELS
-Teacher's Manual and Solution Key

Lipschutz
FINITE MATHEMATICS, (Schaum Publishing Co.)

M.J. Moroney
FACTS FROM FIGURES, (A Pelican Book)

Kaber and Rynyon
GENERAL STATISTICS, 2nd edition, (Addison-Wesley)
- Teacher's Manual
- Student Workbook

Mosteller, Rourke, Thomas
PROBABILITY WITH STATISTICAL APPLICATIONS, 2nd edition, (Addison-Wesley)
- Teacher's Manual

Meserve
INTRODUCTION TO FINITE MATHEMATICS, (Addison-Wesley)

Ingram
INTRODUCTORY STATISTICS, (Cummings)

Mosteller, Rourke, Thomas
PROBABILITY A FIRST COURSE, (Addison-Wesley)
- Instructor's Manual

Freund
MATHEMATICAL STATISTICS, (Prentice-Hall)

Zuwaylif
GENERAL APPLIED STATISTICS, (Addison-Wesley)

Malik and Mulklen
A FIRST COURSE IN PROBABILITY AND STATISTICS

Y.E. Bates
PROBABILITY, (Addison-Wesley)

Morris H. De Groat
PROBABILITY AND STATISTICS, (Addison-Wesley)

SETS, PROBABILITY AND STATISTICS — THE MATHEMATICS
OF LIFE INSURANCE
The Canadian Life Assurance Assn.
44 King Street West
Toronto 1, Ontario.

Stephen S. Willoughby
PROBABILITY AND STATISTICS, (Silver-Burdett) (GLC, Canada)

Joan Gary Taylor, et al
FINITE MATHEMATICS, 1973, (Harper and Row),
(Fitzhenry and Whiteside)

Meyer
INTRODUCTORY PROBABILITY AND STATISTICAL APPLICATIONS,
2nd edition, (Addison-Wesley)

Wisner
ELEMENTS OF AVAILABILITY, (Scott Foresman)